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AIR TRAFFIC ORGANIZATION

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FAA
Health and Usage Monitoring Systems (HUMS) Research and Development

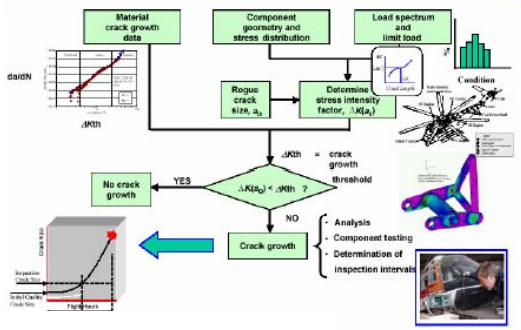
Dy Le

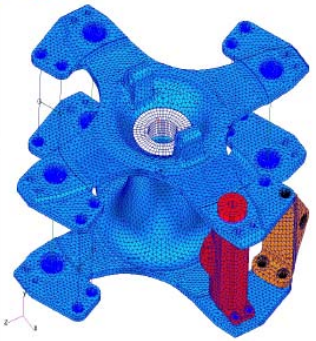
December 9, 2004

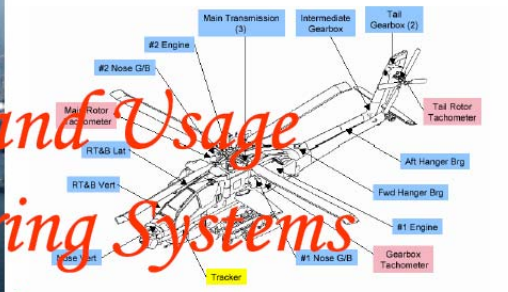
RCDT & HUMS Project Review Meeting

NASA Ames, Mountain View - California

Rotorcraft Structural Integrity and Safety







Health and Usage Monitoring Systems (HUMS)

Aging Aircraft Research Sponsorship

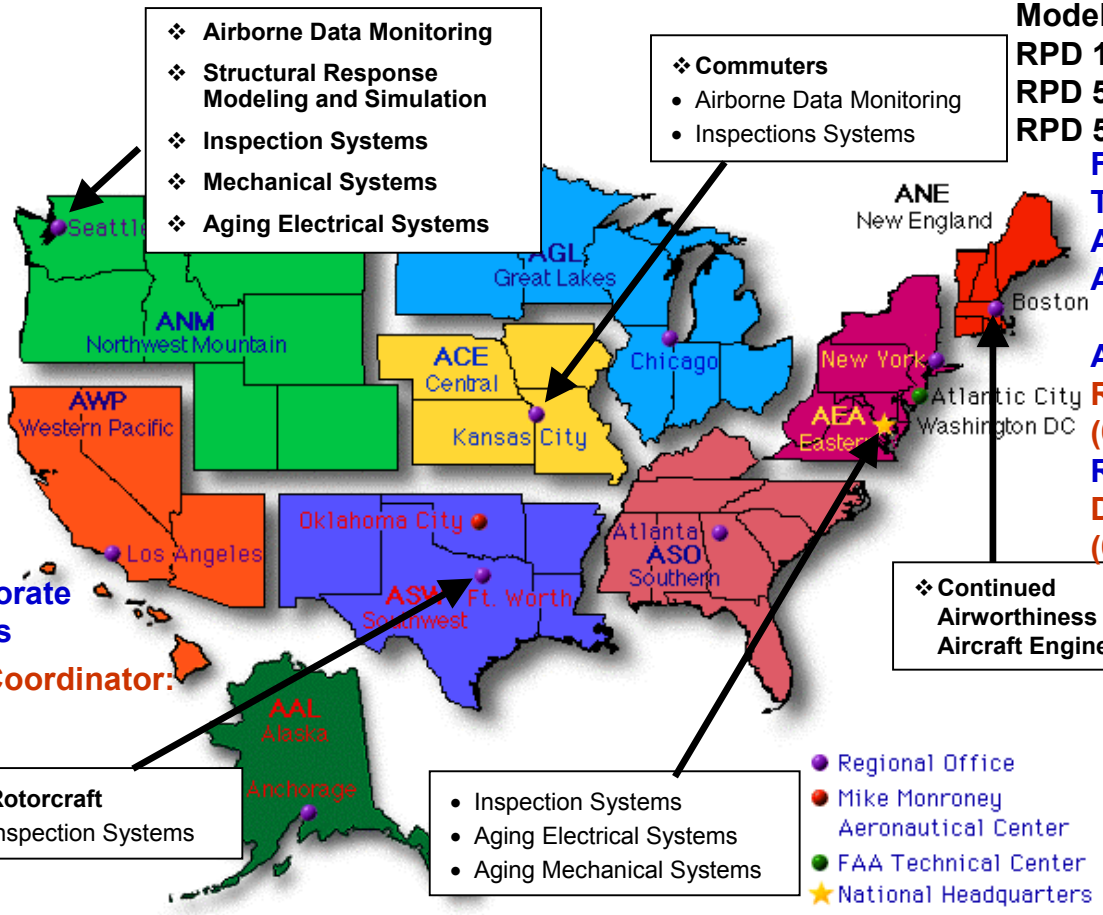
Aging Aircraft Research

RPD 584 Inspection Systems
RPD 672 Mechanical Systems
RPD 673 Electrical Systems
RPD 510 Aircraft Data Monitoring
RPD 515 Structural Response Modeling
RPD 161 Commuter Aircraft
RPD 519 Rotorcraft
RPD 556 Airworthiness of Engines

FAA William J. Hughes Technical Center
Atlantic City International Airport, NJ

Aging Aircraft Research
Rob Pappas, Program Manager
(609) 485-6181
Rotorcraft Research
Dy D. Le, Program Manager
(609) 485-4636

Rotorcraft Directorate
Fort Worth, Texas
Rotorcraft R&D Coordinator:
Edwin G. Cuevas
(817) 222-5355

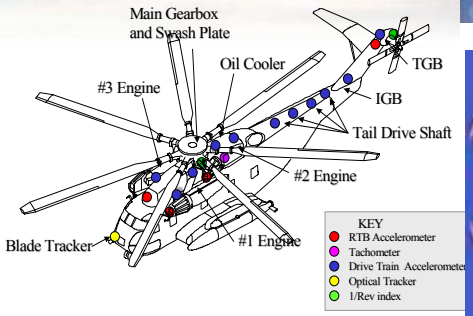


❖ *primary sponsorship for projects,*
● *secondary support.*

HUMS R&D Requirements

Program Objectives:

- ✈ Provide ACO with guidance and and technical information including data for HUMS installation, maintenance credit, and continued airworthiness plan.
- ✈ Merge HUMS and fatigue including DT technologies to maximize safety benefits.



Technical Approaches:

- ✈ Collaborate with rotorcraft community (e.g., NRTC, RCOE, DoD, NASA, RITA, academia, manufacturers) to conduct a wide range of HUMS R&D.
- ✈ Collaborate with DoD and helicopter operators to collect usage data.
- ✈ Fully validate and transfer HUMS technologies to rotorcraft industry and users for certification and compliance.

Support:

- ✈ AC's 29.2A & 27.1A, HUMS, 20.95,
- ✈ FAA Order 8110.9
- ✈ Damage Tolerance Rulemaking, FAR's 29.571 & 27.571,

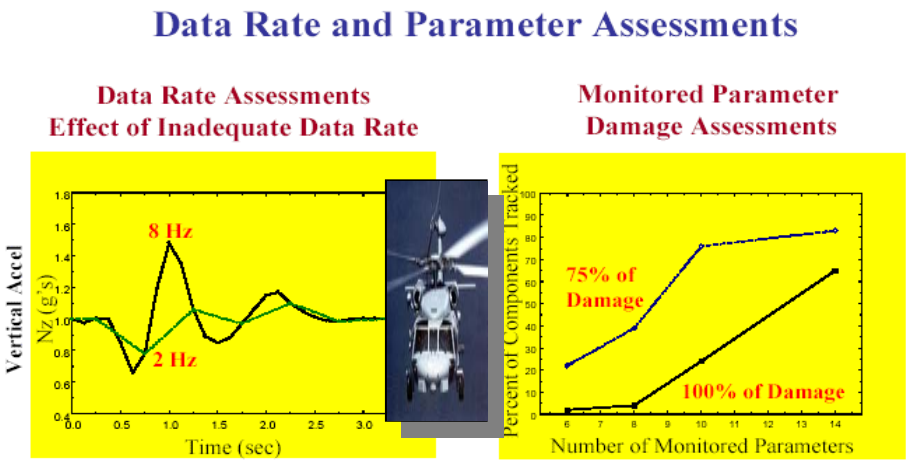
Major HUMS R&D Areas

- HUMS R&D will include efforts covering all aspects of HUMS development and certification.
  - Rotorcraft Operational Development of HUMS
  - Commercial HUMS Validation
  - HUMS Onboard Warning
  - Flight Testing With HUMS-Installed Helicopters
- Additionally, combined DT and HUMS technologies to address safety will also be considered.

Operational HUMS Development

Technical Objectives:

- Determination of HUMS system requirements/processes for various applications and mission mix.
  - Installation
  - Credit Validation
  - Continued Airworthiness Plan



Technical Approaches:

- Conduct assessment and identification of key design parameters and sampling rates required for monitoring systems.
- Conduct the functional/usage hazard assessment of a HUMS.
- Evaluate various types and levels of severity of system degradation to determine the impact on overall structural monitoring capability.
- Validate FCR algorithms and health monitoring techniques for impending problem recognition.

Outputs:

- Guidance and technical information including data to be used in existing HUMS AC and any new regulatory material as required.
- Complete system operational requirements including ground based COTS, onboard monitors, and recording systems to be included in AC.

Commercial HUMS Validation

Technical Objectives:

- Evaluation of HUMS during the design, fabrication, installation, credit validation, and flight tests to assure that the means of compliance practices are adequate and just for the systems intended.

Technical Approaches:

- A commercially-developed HUMS system will be installed and evaluated using the HUMS AC.
- Using WJHTC's S-76 flying test bed and/or other aircraft, usage credit and maintenance action issues will also be addressed.
- Flight-tests are to be conducted using scripted flights for validation of flight condition algorithms and measure loads.

Outputs:

- Guidance and technical information including data to be used in existing HUMS AC and any new regulatory material as required.
- Outputs will also include assessments of rotorcraft fatigue spectrums and mission profiles that can be used in damage tolerance and fatigue spectrum definition.

HUMS Onboard Warning

Technical Objectives:

- Assessment of onboard warning and display devices to determine their reliability, functionality, and required response or action on warnings.

Technical Approaches:

- Evaluate types of devices and information to be displayed or audible.
- Assessment of pilot interface with operational aspects of the system.
- Study of pilot's response or reaction on warnings

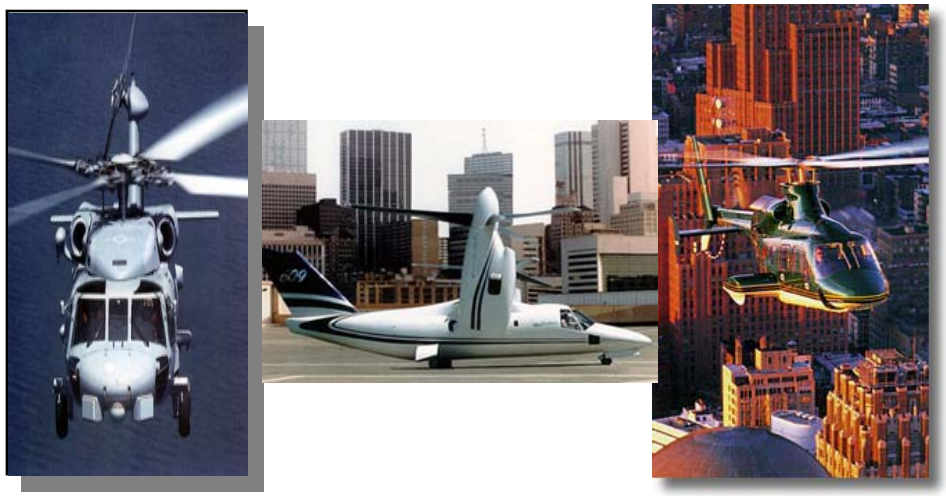
Outputs:

- Requirements for onboard warning and display systems or devices.
- Guidelines for pilots or ground-based personnel required to respond to onboard warning and display.

HUMS Flight Tests

Technical Objectives:

- Validation and assessment of various aspects of HUMS including guidance and information obtained from:
  - Operational HUMS Development
  - Commercial HUMS Validation
  - HUMS Onboard Warning



Technical Approaches:

- Utilize S-76 and others available at Technical Center.
- Collaborate with DoD including U.S. Coast Guard and NASA to install commercially-developed HUMS on their helicopters.
- Utilize commercial helicopters being used by U.S. operators and OEM's for HUMS flight tests.

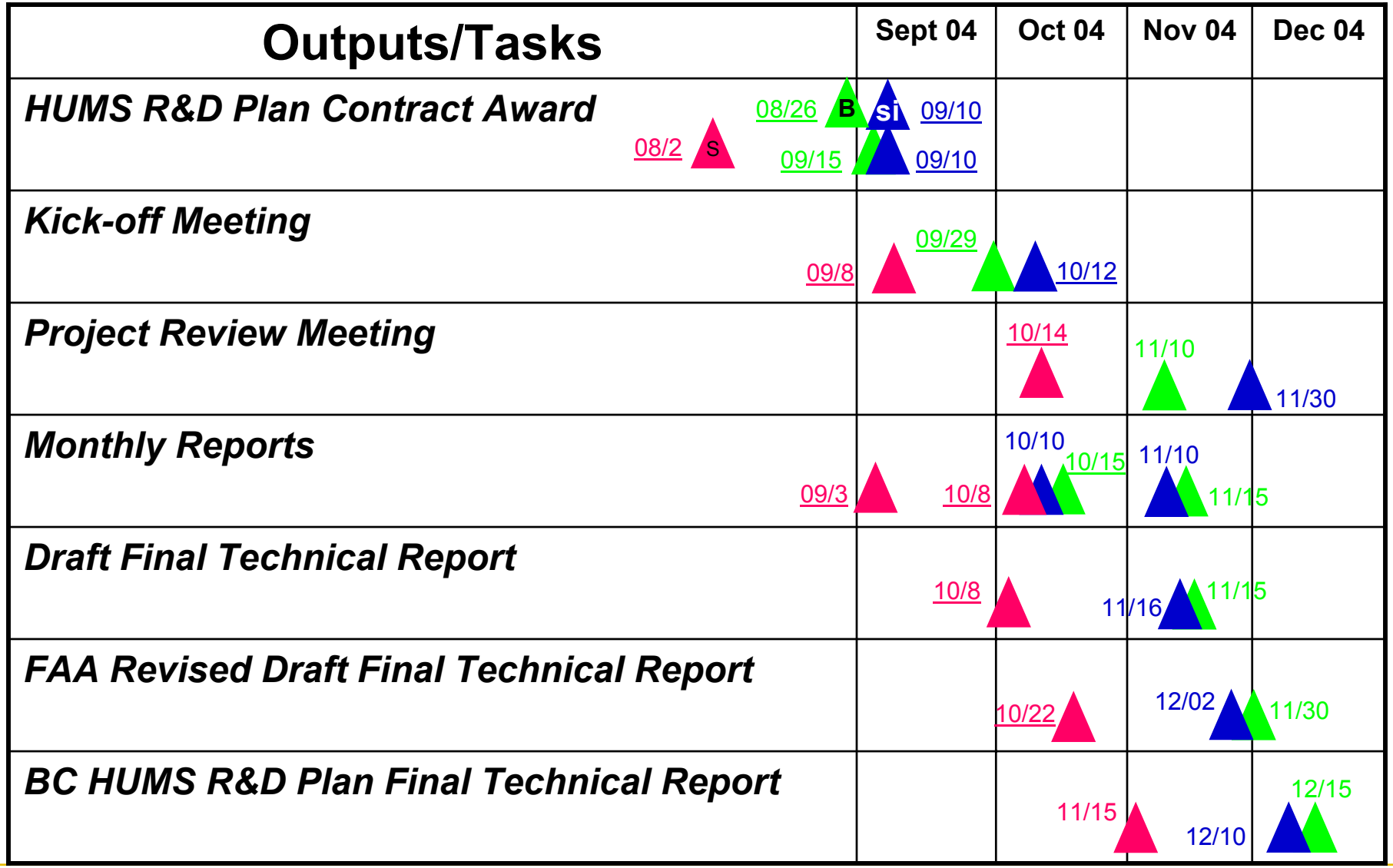
Outputs:

- Technical information including data and processes for:
  - Ground-based COTS, on board monitors, and recording systems.
  - FCR algorithms and monitoring techniques
  - Design, fabrication, installation of HUMS
  - Guidelines for pilots or ground-based personnel required to respond to onboard warning and display devices.
  - Typical rotorcraft fatigue spectrums and mission profiles that will be used in damage tolerance and fatigue spectrum definition.

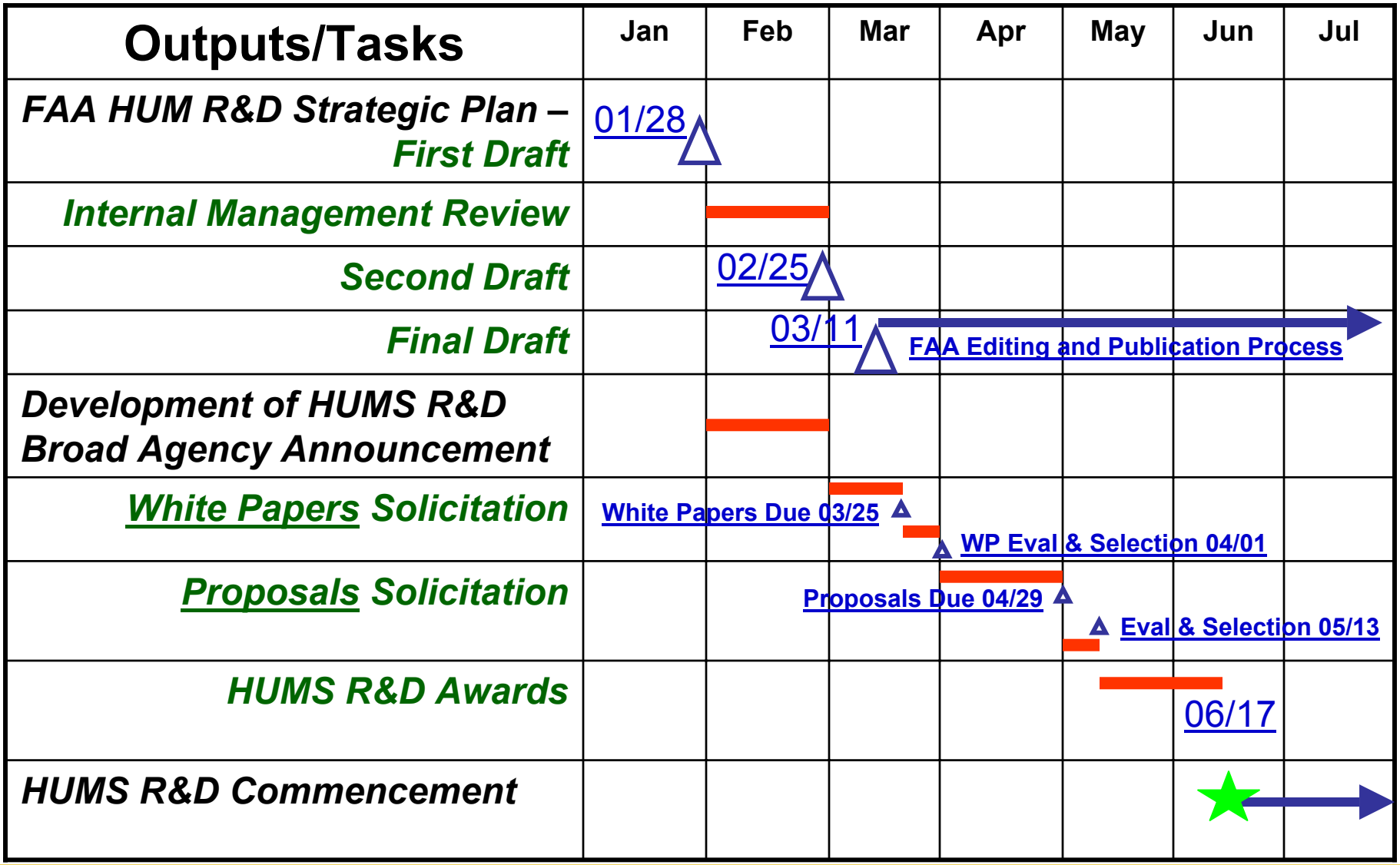
Overview of HUMS R&D Plan Development

- In collaboration with HUMS community, the FAA is supporting the development of HUMS R&D plan.
  - ID current HUMS technologies.
  - Define critical HUMS issues and quantify gaps.
  - Develop HUMS R&D and milestones with prioritized tasks.
  - Develop HUMS output requirements and formats.
  - ID R&D resources and develop costs required to meet HUMS R&D requirements.
  - Develop HUMS R&D exit criteria.
- Draft HUMS R&D roadmap and plan avail - 1st Quarter of FY05.

Industry HUMS R&D Plan
Key Milestones & Deliverables



FAA HUMS Activities – 2005 Projected Schedules



Email: Dy.Le@faa.gov
Phone: (609) 485-4636
Fax: (609) 485-4004

www.ato.faa.gov

http://airportaircraftsafetyrd.tc.faa.gov

Questions?